Appendix E

Auger Type Drill Rig Mounted on 90,000-lb Class Hydraulic Excavator

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Appendix E

Auger Type Drill Rig Mounted on 90,000-lb Class Hydraulic Excavator

INTERNATIONAL CONSTRUCTION EQUIPMENT

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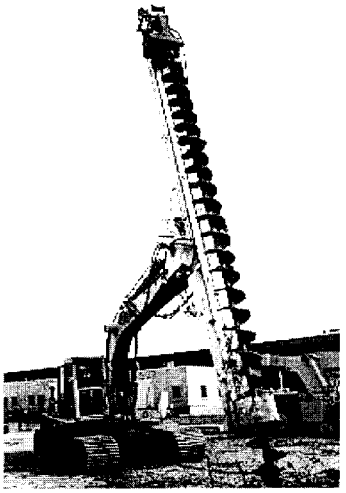
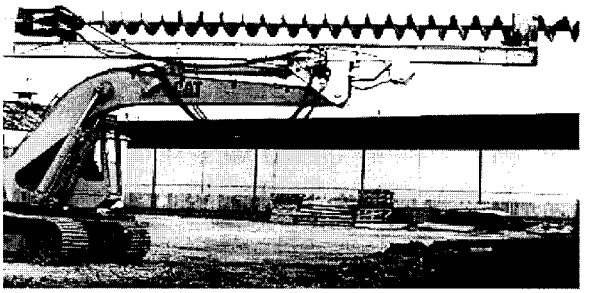
Model 3030 Drill Mast

Drilling holes for foundation work has never been more affordable and convenient. Excavator mounting provides contractor versatility with minimum investment. Heavy-duty construction and easy mounting allow high production and mimumum set-up time.





- **30' (9.1m) maximum drilling depth**
- **30" (762mm) maximum drilling diameter**
- **30,000 lb (133 kN) extraction force**
- **15,000 lb (66 kN) crowd force**
- **Self erecting**
- **Designed for excavators of 90,000 lbs and up**
- **Uses ICE Model 3060 auger or equal**
- **Adjusts fore & aft using excavator cylinder.**
- **10° side-to-side adjustment**
- **Controlled by excavator joy-sticks**
- **No modifications to excavator hydraulic system**
- **Optional 3" (75mm) grout swivel**

Technical data - Model 3030 Drill mast

Max. drilling depth	30 ft	9.1 m
Max. drilling diameter	30 in	760 mm
Max. torque	30,000 ft-lb	40 kNm
Crowd stroke	30 ft	9.7 m
Extraction pull with top winch	30,000 lbs	133 kN
Down crowd with rear winch	15,000 lb	66 kN
Weight with ICE 3060 auger and 24"(610mm) flighting	16,200 lb	7350 kg
Minimum excavator weight	90,000 lb	40,000 kg

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Appendix F

Injection Grouting Methods, Hayward Baker

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Appendix F

Injection Grouting Methods, Hayward Baker

HAYWARD BAKER INC.

JET GROUTING

Hayward Baker's jet grouting systems offer a unique degree of design flexibility for a broad range of applications.

Excavation support begins for construction of Atlantic City, NJ's new expressway extension.

Jet grouting is a Ground Modification℠ system used *to create* in situ, cemented formations of soil called Soilcrete.

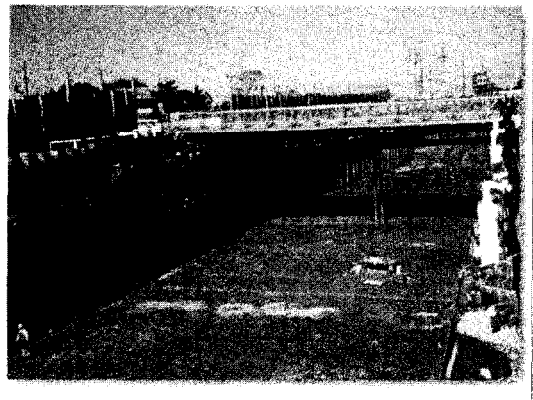
Applications of the jet grouting system fall into three broad categories:

- underpinning and/or excavation support
- temporary or permanent stabilization of soft and/or liquefiable soils, and
- groundwater or pollution control

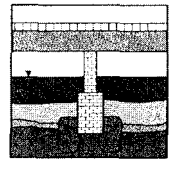
Jet grouting is an alternative to traditional grouting systems, deep slurry trenching, proprietary underpinning systems, micropiling, or the use of compressed air or freezing in tunneling.

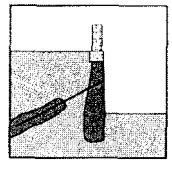
The ability to construct Soilcrete in confined spaces and around subsurface obstructions such as utilities, provides a unique degree of design flexibility. Indeed, in any situation requiring control of groundwater or excavation of unstable soil (water-bearing or otherwise) jet grouting should be considered.

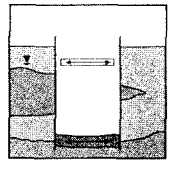
Usually, jet grouting can be accomplished without disrupting normal facility operations. Jet grouting is not only one of the safest methods of construction available but in many cases the process is so fast that construction schedule savings are realized.

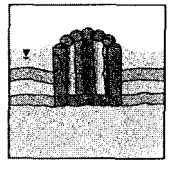


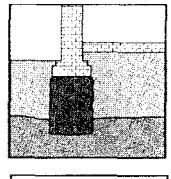
SuperJet struts support the tunnel alignment between the existing Penrose Canal and an established residential area.

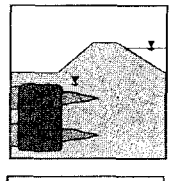


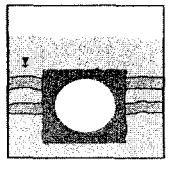










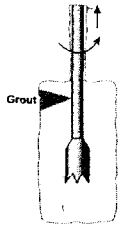


HAYWARD BAKER
A Keller Company

KELLER

Jet Grouting Systems and Applications . . .

There are three traditional jet grouting systems. Selection of the most appropriate system is generally a function of the in situ soil, the application, and the physical characteristics of Soilcrete required for that application. However, any system can be used for almost any application providing that the right design and operating procedures are used.

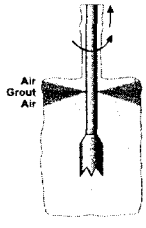


Single Fluid Jet Grouting (Soilcrete S)

Grout is pumped through the rod and exits the horizontal nozzle(s) in the monitor with a high velocity [approximately 650 ft/sec (200m/sec)]. This energy causes the erosion of the ground and the placement and mixing of grout in the soil. In gravelly soils, Soilcrete column diameters of 2-4 ft (0.6-1.2m) can be achieved. In loose, silty and sandy soils, larger diameters are possible. Single rod jet grouting is generally less effective in cohesive soils.

Soilcrete S Applications

- *Cutoff walls in porous soil*
- *Soil consolidation for tunnel roof*
- *Bottom bracing for deep trenches in soft soil*
- *Anchorages*
- *Sealing applications*

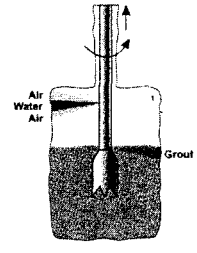


Double Fluid Jet Grouting (Soilcrete D)

A two-phase internal rod system is employed for the separate supply of grout and air down to different, concentric nozzles. Grout is used for eroding and mixing with the soil. The air shrouds the grout jet and increases erosion efficiency. Soilcrete columns with more than 3 ft (1.0m) diameter in medium to dense soils and more than 6 ft (1.8m) in loose soils may be achieved. The double rod system is more effective in cohesive soils than the single rod system.

Soilcrete D Applications

- *Soil stabilization*
- *Some underpinning applications*
- *Panel cutoff walls*
- *Bottom bracing for deep trenches in soft soil*

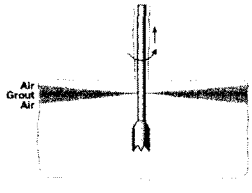


Triple Fluid Jet Grouting (Soilcrete T)

Grout, air and water are pumped through different lines to the monitor. High velocity coaxial air and water form the erosion medium. Grout emerges at a lower velocity from separate nozzle(s) below the erosion jet. This somewhat separates the erosion process from the grouting process and yields a higher quality Soilcrete. Soilcrete columns with diameters ranging from 3 ft (0.9m) to more than 5 ft (1.5m) can be achieved. Triple rod jet grouting is the most effective system for cohesive soils.

Soilcrete T Applications

- *Underpinning and excavation support*
- *Horizontal slab/ground water control*
- *Panel cutoff walls*
- *Sealing applications*
- *Most fine grained soil stabilization*



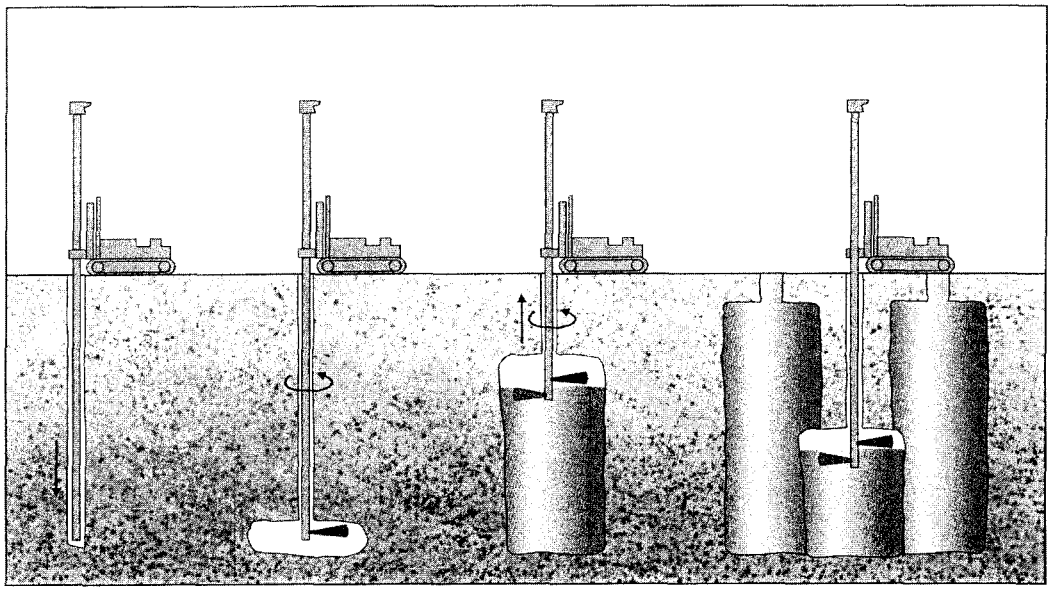
SuperJet Grouting

Grout, air and drilling fluid are pumped through separate chambers in the drill string. Upon reaching the design drill depth, jet grouting is initiated with high velocity, coaxial air and grout slurry to erode and mix with the soil, while the pumping of drilling fluid is ceased. This system uses opposing nozzles and a highly sophisticated jetting monitor specifically designed for focus of the injection media. Using very slow rotation and lift, Soilcrete column diameters of 10-16 ft (3-5m) can be achieved. This is the most effective system for mass stabilization application or where surgical treatment is necessary.

SuperJet Applications

- *Horizontal slab/ground water control*
- *Stabilization of liquefiable strata*
- *Panel cutoff walls*
- *Structural supports across excavation walls*
- *Stabilization of soft soil for microtunneling*

"The experience of the specialty contractor in selecting the optimum jet grouting system and operating procedures is a critical part of a technically and economically successful project."



Jet Grouting Procedure

Predrilling or foundation coring may be necessary to access the treatment zone. The drilling rig is positioned and drilling, typically 6 inches dia (150mm), is performed using grout or a drilling mud to stabilize the borehole. Since jet grouting is a bottom-up procedure, erosion is initiated at the design depth with high velocity injection of cutting and replacement fluids. This continues with consistent, uniform rotation and lifting to create column geometry, while expelling eroded spoil out of the top of the borehole. Designed integration of adjacent columns creates a Soilcrete mass. Since jet grout equipment operates from above foundation grade, and Soilcrete is constructed in a designed sequence, structural integrity is maintained and safety considerations are simplified. Jet grouting equipment is specially designed to be highly maneuverable and capable of low-headroom interior work as well as restricted-access exterior work.

Jet Grouting Geotechnical and Structural Considerations

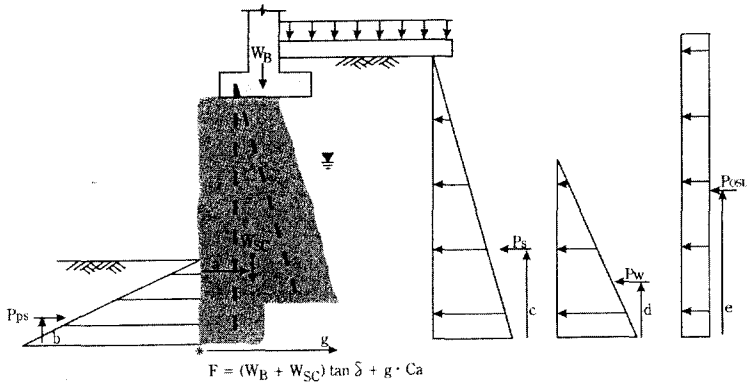
Jet grouting is effective across the widest range of soil types of any grouting system, including silts and some clays. Because it is an erosion based system, soil erodibility plays a major role in predicting geometry, quality and production. Cohesionless soils are typically more erodible than cohesive soils, as shown at right. Since the geometry and physical properties of the Soilcrete are engineered, the degree of improvement is readily and accurately predictable.

Highly Erodible

Cobbly Soils
Gravelly Soils
Clean Sands
Loose Silty Sands
Peats and Organic Silts
Dense Silty Sands
Loose Clayey Sands
Low Plasticity Silts
Dense Clayey Sands
Low Plasticity Clays (soft)
High Plasticity Silts
Low Plasticity Clays (stiff)
High Plasticity Clays

Difficult to Erode

Jet Grouting Design and Quality Control . . .



$$F = (W_B + W_{SC}) \tan \delta + g \cdot Ca$$

$$\text{FS overturning}^* = \frac{(W_B + W_{SC})\,a + P_{ps} \cdot b}{(P_s \cdot c) + (P_w \cdot d) + (P_{OSL} \cdot e)} \geq 1.5 \qquad \text{FS sliding} = \frac{P_{ps} + F}{P_s + P_w + P_{OSL}} \geq 1.5$$

LEGEND	
a,b,c,d,e	Moment arms
Ca	Base soil adhesion
δ	Base soil friction angle
F	Friction force
FS	Factor of safety
P_s	At-rest or active soil force
P_{OSL}	Surcharge force
P_{ps}	Passive force
P_w	Hydraulic force
W_B	Weight of structure footing load
W_{SC}	Weight of Soilcrete
W_{SL}	Surcharge load

Jet grouting systems can be designed to mix the soil with a grout or nearly replace it with grout. For underpinning and excavation support (with groundwater control), the design consists of developing a contiguous Soilcrete mass to resist overturning and sliding while maintaining the integrity of supported structures and nearby utilities.

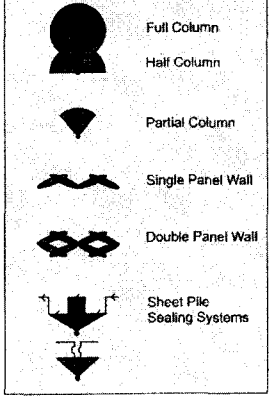
The design engineer should assess the competency of the soils at the base of the Soilcrete for bearing and settlement. Evaluation of internal stresses (shear and bending) in the Soilcrete will provide guidance for required Soilcrete strength. Soilcrete strength is a function of the in situ soils and strength variations are to be expected. A factor of 3.0 is therefore applied to the required Soilcrete strength for an average allowable strength.

Soilcrete Design and Operating Parameters

Theoretically, treatment depth is unlimited, but Jet Grouting has rarely been performed in depths greater than 164 ft (50m). Treatment can also be pinpointed to a specific strata. The size of the Soilcrete mass to be created is determined by the application. A variety of geometries are available as shown at right. The width or diameter of each panel or column is determined during the design stage. Accurate, detailed and frequent description of soil type, with reasonable assessment of strength or density allows this prediction to be made with confidence. If required, shear and/or tensile reinforcement can be incorporated into the Soilcrete.

The operating parameters of air, water and/or grout flow, and pressure, together with monitor rotation and withdrawal speed are selected (following detailed engineering assessment of soil conditions) and automatically controlled and monitored throughout construction. Reduced flow or increased withdrawal speed produces a smaller Soilcrete geometry.

SOILCRETE PLAN GEOMETRIES



"A properly designed structure should be analyzed by a professional engineer familiar with the site conditions and technologies applied."

Quality Assurance

Quality assurance and quality control are critical components of a successful jet grouting program, ensuring that subsurface soils are consistent with design assumptions and that design parameters are met or exceeded throughout the project.

Quality assurance begins with a test section to verify the design geometry of the Soilcrete and the quality and strength characteristics of the Soilcrete product.

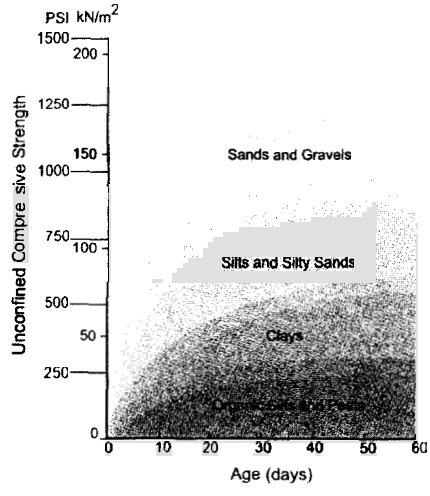
Retrieved wet-grab and core samples are laboratory tested to confirm that satisfactory unconfined compressive strengths are achieved. The pre-production quality assurance measures form the basis for quality control during production grouting. Computerized data collection of all jet grouting parameters is available along with continuous real-time observation.

Quality Control

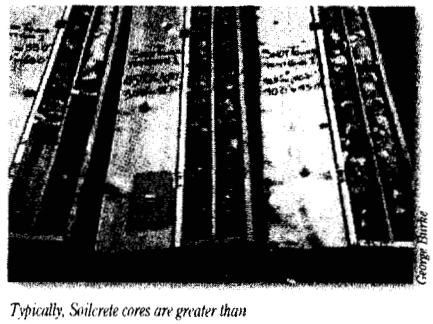
In addition to the quality control inspection items for Soilcrete element construction, additional project-specific quality control measures such as structural monitoring or permeability testing may be required.

Controlled jet grouting must create a spoil material during the erosion process. The volume of spoil can be predicted from the injected volumes and is typically in the range of 40-60 percent of the Soilcrete volume. The spoil retains a significant cement content, and gains strength over time. Within 12 hours it can typically be handled as a firm to stiff clay and is frequently used as a construction fill.

QUALITY CONTROL INSPECTION ITEMS	
Drilling	Location, angle, depth, methods to maintain repeatability
Batching	Preparation of grout slurry for consistency in material content and physical and chemical properties
Jetting	Checking of drill parameters (lift, speed, rotation rate) and injection parameters (pressure and flow of all components)
Documentation	Accurate documentation for each element constructed. Construction times and correlation to any sampling performed
Sampling and Testing	Retrieval of representative samples for external testing



Soilcrete strengths are variable and difficult to predict, particularly in layered soils. This chart represents an estimate of average results expected.



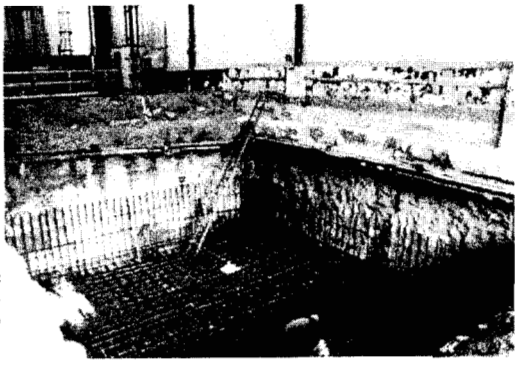
Typically, Soilcrete cores are greater than 3 inches in diameter and recovery is greater than 75 percent with specialized coring equipment.

Jet Grouting Case Histories . . .

Nimitz Relief Sewer
Honolulu, Hawaii

As a value-engineered and less disruptive alternative to open cut construction, jet grouting was selected to provide a homogenized tunnel horizon and minimize post-construction settlement for the installation of a 54 inch (1.4m) relief sewer through soft, lagoonal deposits. Two rows of interconnected, 4 ft (1.2m) dia Soilcrete columns were installed to bedrock over a 2,800 lf (850 linear meter) stretch of tunnel alignment to prepare an encapsulated tunnel horizon for micro-tunneling. In addition to providing a fully stabilized tunneling face, the Soilcrete mass ensured that post-construction settlement of the sewer would be eliminated.

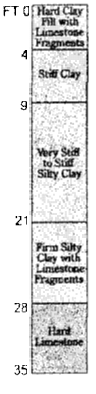
Spencer Parr



Hayden Peterson

Kraft Foods
Dover, Delaware

For construction of a 20 ft (6m) deep railcar unloading pit within an existing building, jet grouting performed three functions: excavation support, underpinning, and groundwater control. To meet project performance objectives, a 'bathtub' configuration was constructed via a perimeter wall of 20 ft (6m) deep, interconnected jet grouted columns enclosing a 6 ft (1.8m) thick jet grouted base. The perimeter columns provided excavation support while those at the corners of the pit also underpinned the existing adjacent footings. The jet grouting program successfully prevented building movement and vertical and horizontal groundwater infiltration.

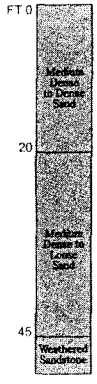


Transmission Towers
Dallas, Texas

Four, 180 ft (55m) high transmission tower structures were moving laterally on the compression leg. This was due to insufficient diameter and embedment length of the drilled shaft foundations. To improve the factor of safety against failure at ultimate loads, jet grouting was used to stabilize the compression leg foundation of each tower down to a competent bearing strata. Prior to production, a test column was constructed to establish effective column diameter, forming the basis for the design. An average of 12, 4 ft dia (1.2m) Soilcrete columns were constructed at each tower to hard limestone.

Hayward Baker

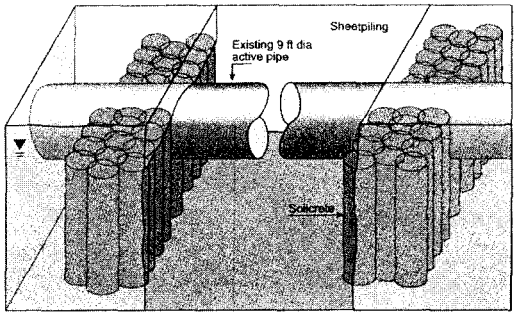
"When owners and contractors need a fast, technically effective solution to a tough geotechnical problem, jet grouting gets the job done."



General Hospital Center at Passaic
Passaic, New Jersey

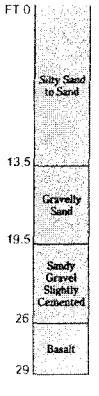
Concerned that a conventional pit underpinning method would result in excessive settlement of the existing, five-story structure, the general contractor elected to use a jet grouting alternative for construction of a new, three-story hospital addition. For the addition, the site was pre-excavated to the top of the existing foundation. Column footings and foundation walls were then underpinned to a competent bearing strata by 3.5 ft dia (1.1m), interconnected jet grouted columns. The continuous Soilcrete wall thus formed also provided support for subsequent deep excavation of the prevailing clean sands. Existing building settlements were negligible.

Jon Chadwick



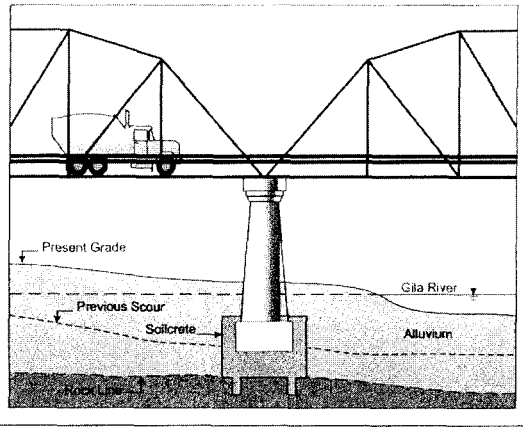
Virginia Key WWTP
Virginia Key, Florida

Prior to incorporation of a storm surge pressure relief system into an existing outfall pipe, all three project requirements of underpinning, excavation support, and groundwater control were met by jet grouting. At each end of the excavation area, jet grouting was performed adjacent to and below the 8.5 ft (2.6m) dia pipe down to limestone bedrock. Angled drilling and jet grouting beneath the pipe invert completed the encapsulation, thus forming a groundwater seepage barrier as well as excavation support and underpinning across the width of the excavation. Sheetpiles connected the sides of the excavation with the grouted zones. Safe operational integrity was maintained throughout the work.



U.S. Highway 80 Bridge
Maricopa County, Arizona

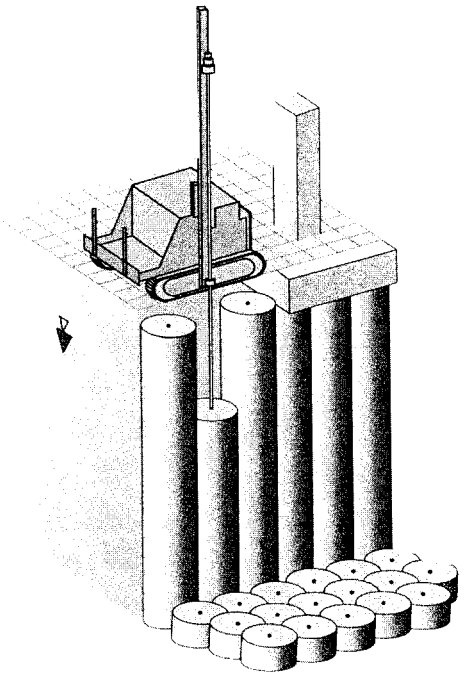
During heavy winter rains in the Arizona desert, the Gillespie Dam failed, sending water up to 150,000 cf (4,250m³)per second down the Gila River. Just 100 yds (92m) downstream, an old bridge for Highway 80 crosses the river. Flood waters were concentrated toward the eastern portion of the nine-span structure, scouring cavities beneath three easternmost piers and resulting in minor settlements and cracking. Jet grouting was recommended as the most economic method of underpinning and protecting the existing footings. Interconnected Soilcrete columns were installed around the upstream portions of the pier and were either keyed into underlying basalt or taken to sufficient depths into underlying alluvium to underpin and protect the footings from future scour.



JET GROUTING

Advantages of Jet Grouting

- *Nearly all soil types groutable*
- *Specific in situ replacement possible*
- *Designable strength and permeability*
- *Treatment to specific subsurface locations*
- *Only inert components*
- *No harmful vibrations*
- *Can be performed in limited working space*
- *Any cross-section of Soilcrete possible*
- *Maintenance-free*
- *Safest method of underpinning construction*
- *Ability to work around buried active utilities*
- *Most effective method of direct underpinning of structures and utilities*
- *Much faster than alternative methods*



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Georgia
770-442-1801

Illinois
847-634-8580

Iowa
515-276-5464

Massachusetts
781-229-7359

New Jersey
201-797-1985

New York
315-834-6603

North Carolina
336-668-0884

Tennessee
865-966-0294

Texas
817-625-4241

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Hayward Baker Inc.
Case Foundation Company
Case Atlantic Company
Keller Cimentaciones de Latinoamerica
Suncoast Post-Tension L.P.

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Appendix G

High Pressure Swivel, Western Rubber Manufacturing

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Appendix G

High Pressure Swivel, Western Rubber Manufacturing

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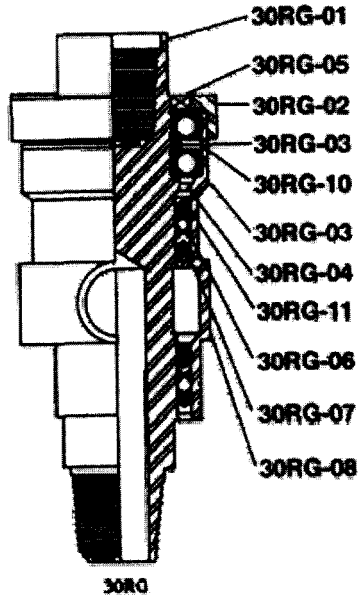
(281) 590-1185

SIDE INLET SWIVEL



30RG

30RG

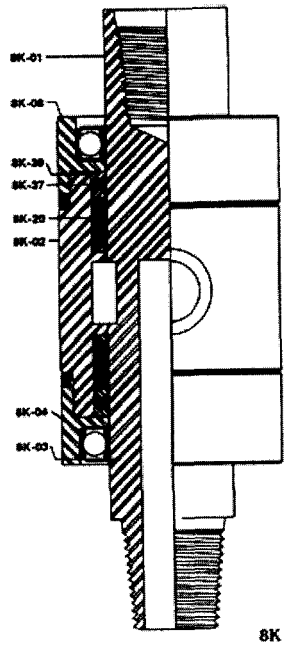
- Can be used to increase fluid passage, maximum of 2-1/2" ID
- Models for both WATER WELL and MINERAL EXPLORATION drilling
- Can be used for both air and mud rotary drilling
- Sealed radial ball bearings for smooth rotation
- Non adjustable Chevron (V-ring) packing, grease lubricated
- Compact design
- Can be easily repaired in the field if necessary
- Available with numerous thread forms and sizes

TECHNICAL

OVERALL LENGTH	WIDTH	TOP* CONN.	HOSE CONN.	LOWER* CONN	WATERCOURSE	WT/LB
21"	8"	3-1/2" REG BOX	2-1/2"	3-1/2" IF PIN	2-1/2"	150
21"	8"	3-1/2" REG BOX	2-1/2"	3-1/2" REG PIN	1-1/2"	150

PARTS LIST

PART NUMBER	NAME	NUMBER REQ	WT/LBS EACH	RECOMMENDED SPARES FOR (1) YEAR
30RG-01	SHAFT**	OPTION	95.00	—
30RG-02	BEARING CAP	1	12.00	—
30RG-03	BEARINGS	2	3.50	2
30RG-04	BEARING RETAINER	1	.10	1
30RG-05	GREASE SEAL	1	.30	1
30RG-06	LANTERN RING	2	.70	—
30RG-07	PACKING SET (HIGH PRES)	2	.70	2
30RG-07-416	PACKING SET (LOW PRES)	OPTION	.70	—
30RG-08	PACKOFF HOUSING	1	40.00	—
30RG-09	PACKING SEAT RING	2	.50	—
30RG-10	BEARING SPACER	1	1.00	—
30RG-11	PACKING RETAINER	2	.10	2



8K

8K (SPECIAL SWIVEL)

- 6,000 PSI Working Pressure
- For High Pressure grouting
- Compact design
- Sealed Radial Ball Bearings for smooth rotation
- Non Adjustable grease lubricated Chevron (V-Ring) packing
- 2" Watercourse
- Numerous applications in the directional drilling market

**PLEASE STATE SIZE AND TYPE OF THREADS WHEN ORDERING.
*OTHER SIZES OF CONNECTIONS AVAILABLE, PLEASE CONSULT FACTORY.

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Appendix H

Active Control of Hydraulic Control Circuits (HMC, MOVAC Auto Sensing II)

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Appendix H

Active Control of Hydraulic Control Circuits (HMC, MOVAC Auto Sensing II)

HMC Foundation Equipment

CO. ATE OFFICE: 3101 NEW HAVEN AVE, FT. WAYNE, IN 46803 USA; TELEPHONE: 800.348.1890, 260.424.0405; FAX: 260.422.2040; http://www.hmc-us.com

The Sonic SideGrip™ with the auto steer control system provides complete spatial data feedback, virtually eliminating the need for ground personnel. One-man control of the system from the operator cab reduces the danger to job site personnel.

I have enclosed manuals, pictures, literature, and video of most if the equipment is being used in different degrees to combination.

Contact Info

Please address any questions or requests for additional information to

Hercules Machinery Corp.
3101 New Haven Ave.
Fort Wayne, IN 46803

Attention Michael Meehan 1-260-615-5203 or John Jinnings 1-260-615-5210

Customers' references and current job usage can be provided on request.

Customer References

R.L. McCoy	260-625-3443, Carl VanAllen
J. H. Maxymillian	413-499-3050, Tony Consolini

HMC Foundation Equipment

MANUFACTURING THE WORLD'S FINEST PILEDRIVING EQUIPMENT SINCE 1974 &
Home to *The Movax*

CORPORATE OFFICE: 3101 NEW HAVEN AVE, FT. WAYNE, IN 46803 USA; TELEPHONE 800-348-1890; FAX 260-422-2040;
WEBSITE http://www.hmc-us.com/

SPECIFICATIONS OF THE MOVAX

- **Separate Upper and Lower Articulating Non-Fixed Side Arms**
- **New Auto II Steering System: plumbs piling with in 1° as you drive or pull**
- **Auto II Includes Self Diagnostics**
- **Side and top gripping and driving capabilities**
- **Handles & drives sheet pile and 8", 10", 12" & 14" H-pile, 40' in lengths**
- **Picks up piling off of the ground or a stack with out assistance**
- **Pick up piling from the ground or truck without losing control**
- **360° Rotation - 30° of tilt from stick pin**
- **Operates with a Joy Stick Control**
- **Picks up 4-6 sheets in one lift at 6,000 lbs.**
- **Excellent capabilities in low overhead and close situations**
- **Full weight: SP-50: 4,114 lbs. SP-100: 5,280 lbs**
- **Wood and Pipe Pile Clamps available**
- **Warranty: 6 months limited warranty (New Units),**

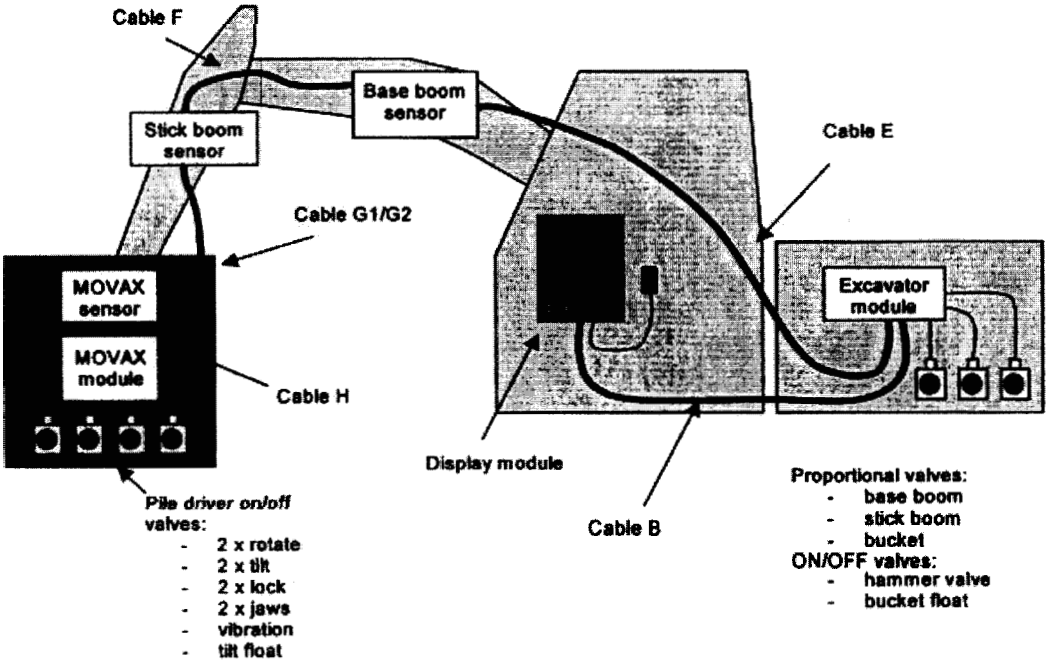
Customers Responsibilities:
The excavator must have an auxiliary circuit at the end of the stick with 1" hydraulic lines. It must also have an electric hammer valve. The hydraulic oil would need to be tested for dirt and impurities and replaced if necessary. All of the pins and bushing on the excavator must be tight and in good working condition. The flow and pressure must be set prior to installation of the Movax. Pressure and flow for the different models are listed below. **HMC will not set flow and pressure.**

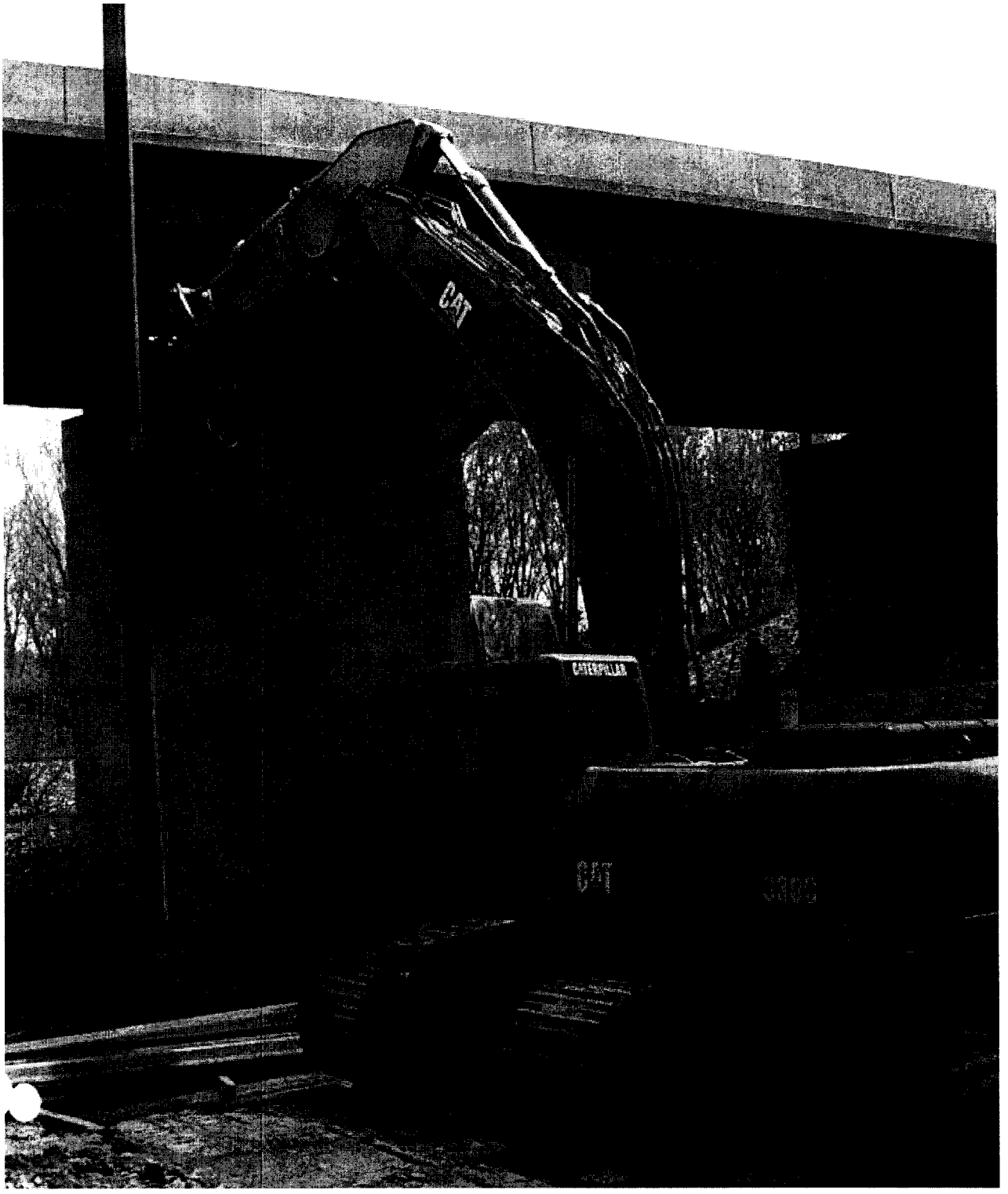
MOVAX MODEL	FLOW/PRESSURE	RELIEF PRESSURE
SP-40	32gpm @ 4000psi	4300psi
SP-50	40gpm @ 4000psi	4300psi
SP-60	47gpm @ 4000psi	4300psi
SP-100	60gpm @ 4500psi	4780psi

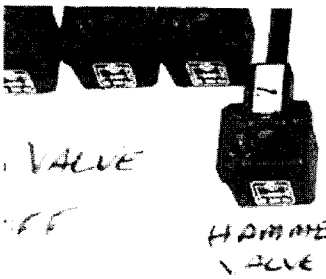
Continued on page #3

Auto II Steering System:

The **Auto II** steering system is designed to *assist* the operator while operating the **Movax**. The **Auto II** steering system includes sensors mounted on the main boom, stick boom and **Movax**. The computer will calculate the positions of these sensors and flow hydraulic oil to either the rod or piston side of the stick cylinder and bucket cylinder. This will assist the operator while driving pile. The **Auto II** steering system will drive pile within 1° of plumb. The system includes 4 hydraulic proportional valves and 6 on/off valves that are installed near the main manifold bank of the excavator. The **Auto II** Steering computer would be installed in the cab complete with a joystick control over the right hand joystick. This allows the operator to have complete control of the **Movax** and the excavator. Main boom sensor, stick sensor and excavator module is installed in conjunction with the sensor mounted on the **Movax**. The **Auto II** steering system is then calibrated and tested by the **HMC** technician.




CAT
CATERPILLAR
CAT


VALVE
HAMMER
VALVE